6-14-2006

Ecology [10th grade]

Matt Simonds
Trinity University

Education Department

Understanding by Design Curriculum Units

Trinity University *Year* 2006

Ecology

Matt Simonds
Trinity University,

UNDERSTANDING BY DESIGN

Unit Title: Ecology (Interdependence)

Grade Level: 10th grade

Subject / Topic Area: Biology / Food webs, nutrient cycles, & interdependence of organisms

Designed by: Matthew Simonds

Time Frame: 3 weeks; 50 minute periods

School District: Harlandale ISD

School: Harlandale High School

School Address and Phone:

114 E. Gerald
San Antonio, TX 78214
(210)977-1300

Brief Summery of Unit

By the end of this unit students will understand that organisms in an ecosystem are interdependent and that an ecosystem is made up of more than just the living things in it. Furthermore, they will be able to create, correctly label, and predict the effects of a given event on a food web.

Throughout this unit students will practice creating and interpreting food webs & nutrient cycles. They will also practice using the appropriate vocabulary as listed in the unit below.

In the performance assessment, students research an ecological issue of their choice and create a report containing an explanation of the issue, a food web, a nitrogen cycle, and a water cycle, each with an explanation of how their ecological issue affects it. Finally, students will compare and contrast their report to another student with a different ecological issue, deciding which issue is the most detrimental to the environment and why.

Unit: Ecology (Interdependence)
Grade: 10th

Stage 1: Desired Results

Understandings

Students will understand that…

- Organisms are interdependent in an ecosystem.
- Both organic and inorganic factors are part of an ecosystem.

Essential Questions	Knowledge & Skill
• How do my actions affect the environment around me? • What affects can extinction have on the environment? • How can the environmental balance be broken? • Which factors make up an ecosystem?	(12)Science concepts. The student knows that interdependence and interactions occur within an ecosystem. The student is expected to: (A) analyze the flow of energy through various cycles including the carbon, oxygen, nitrogen, and water cycles (E) investigate and explain the interactions in an ecosystem including food chains, food webs, and food pyramids.

Enabling skills:

- Ability to conduct internet research
- Ability to use knowledge to infer relationships
- Knowledge of lab report format
- Ability to correctly cite sources in desired format

Students will know…	*Students will be able to…*
• That 10% of the energy is transferred btw trophic levels • A food web is more accurate depiction of the feeding relationships in an ecosystem. • Science vocabulary	• Read a food web and identify the different levels • Calculate the energy transferred btw each level • Hypothesize about the effect of various events on an ecosystem • Interpret charts and graphs related to environmental observations • Graph the results of an ecological experiment

Science Vocabulary

Ecology	*Food chain*	*Primary consumer*
Autotroph	*Food web*	*Secondary consumer*
Heterotroph	*Energy pyramid*	*Tertiary consumer*
Herbivore	*Producer*	*Decomposer*
Carnivore	*Consumer*	*Biomass*
Omnivore		

Misconceptions:

- Arrows on a food web are showing energy flow, not what the animal eats.

Stage 2: Assessment Evidence

Students research environmental problem determining what animals live in that location and its impact on the environment.

1. Research about the problem: what it is what is causing it, and what a solution might be?
    a. What causes your ecological issue?
    b. What areas does it affect?
    c. How could it have been prevented?
    d. Now that the issue has occurred, what can we do about it?
        i. What are some proposed solutions?
    e. What do you think will happen if this issue continues?
2. Construct a food web for your area containing at least the following:
    a. Producers (2)
    b. Primary consumers (4)
    c. Secondary consumers (3)
    d. Tertiary consumers (1)
    e. Decomposers (2)

    Some of the organisms can overlap. For example, an organism that is both a primary and secondary consumer would count as one for each category.
3. Construct a picture of the water cycle for your area.
    a. Use a picture of the area where your issue is occurring and draw the water cycle over that, showing all parts of the water cycle that occur in your environmental issue. (Not all of the parts of the water cycle will be present in each environmental issue, but most of them should)
4. Construct a picture of the nitrogen cycle for your area.
    a. Again use a picture of the area where your environmental issue is taking place and draw the nitrogen cycle on top of that, clearly labeling each part of the cycle.
5. Label on steps 2-4 where your environmental problem is having an effect. For example:
    a. On the food web, label each organism that is being affected by your issue with a small explanation of how it is affecting the organism. (If your environmental issue affects all of the organisms in an ecosystem, then thoroughly explain the affect for one organism (ex. Bear) and label the rest as "See bear". But make sure to explain any differences that may exist.
    b. On the water cycle, add a note to the cycle labeling those parts of the cycle being disrupted by the ecological issue.
    c. On the nitrogen cycle, same as the water cycle.
6. Partner up with a person who has a different research topic and compare and contrast your two environmental issues, using step 5 as your main source of comparisons. Then determine which of the two issues you believe is worse for the environment and provide evidence and reasoning for your choice.

Possible research topics include but are not limited to the following:

1. Edwards aquifer land development over recharge zone
2. Ongoing drought in Texas specifically effects on the Edwards aquifer.
3. Air pollution (specific event)
4. Water pollution (specific event)
5. Invasive species (historical: conquest of Mexico, frogs in Australia, or fire ants in the United States)

Other evidence:

1. Warm ups entrance slips
2. Build a food web using given organisms and descriptions
3. Food web quiz (Day 4)
4. Lab Report on Bean Hunter Lab
5. Interpreting graphs and charts related to ecology

Stage 3: Learning Activities

Day 1 (All days are 50 minute periods)

Tell students that they will now be learning about ecology. Explain to students that you are going to show them several slides of what an ecologist studies and then several slides of what he does not study. Have students try to identify similarities between the "Example" pictures, and come up with a definition for the word ecology as "the study of …" Hand out vocabulary sheets with definitions already on the sheet, except for the definition of ecology only have "the study of…"

Next, explain we are going to start learning about the living things part of ecology, covering the non-living part later. Have a picture on the power point that takes up the whole screen and then have students list the organisms that they see. Then using their vocabulary sheet they can classify the organisms as either: autotrophs or heterotrophs, creating a T chart on a separate piece of paper. Call on students randomly to share out with the class where they placed an organism and why. Continue the questioning with new organisms, not on the picture, (include additional photographs on the PowerPoint for students to see). Expand on this concept and start asking them to identify if it is an herbivore, carnivore, or omnivore.

Day 2

Begin class with a review of the previous class. Students will identify from a PowerPoint what is and is not studied in Ecology. Then have students identify those organisms that are heterotrophs, autotrophs, herbivore, carnivore, and omnivore. (Quick grade warm up)

Ask students who remembers food chains from previous years. If someone does, then have them define it for the class. Otherwise, define it for class. Continue to introduce Food chains for students and have students create several food chains for one collection of organisms. (Each animal must be in a food chain). Students should realize that this is not very efficient and that there are multiple paths that could be taken. Thus many food chains have to be created to show all the different paths.

Introduce Food webs. Have students turn list of organisms from food chains into a food web. Students should then consider the benefits of a food web over a food chain. (Homework / End of class) to turn a list of organisms into a food web, labeling which are autotrophs and which are heterotrophs.

Note: Make a point of addressing which way the arrows go. Showing that they indicate the flow of energy

Day 3

Revisit the food web, asking random students to identify what eats this or that animal and what this or that animal eats, using a given food web. Now move on to identifying each organism as a producer, primary consumer, secondary consumer, or tertiary consumer. Have random student read the definition from the vocabulary sheet. Then another random student identifies an example on the food web. Also, introduce 10% energy transfer between levels. Have students practice with examples and situations

Day 4

Quiz over labeling and energy transfer. Students take a list of organisms and compile them into a food web. Then compiles a list of all of the producers/prime c/second c/ tertiary c. Finally, student will solve two or so energy transfer questions that use organism from the food web.

Show students an example food web, prompt them with this question, "What would happen if we doubled the number of _____ in this ecosystem?" Accept any answer that is reasonable, letting students share out as many ideas as they can come up with. Then explain that they will be doing a lab tomorrow where they take the place of an animal that has an overabundance of food to eat. Have them hypothesize about what they think will happen to the population and record their hypothesis for use the next day.

Day 5

Overpopulation lab (Bean hunter lab but with rotini pasta)

A set number of food is supplied each round, and the simulation starts with just one predator (student). If the student gets enough food he will "reproduce" bringing a second student into the simulation. This continues with all students recording the number of "predators" each generation / turn. Continue this patter until about 15 rounds have been completed, or until the number of predators has leveled off.

Return to the classroom and have students begin graphing the results.

Day 6

Finish graphing results and analyze graphs of bean hunter lab. Students should then begin writing their lab reports in the computer lab. Students should finish their reports at home and turn them in by Day 8.

Day 7

Nutrient cycles: In groups of 3 students will use a large laminated picture of the Nitrogen cycle minus the arrows or labels. Students must then use a clue sheet to fill in the labels and arrows for the Nitrogen cycle. Finally, students will answer a couple of questions about the cycle, such as, "Is Nitrogen ever destroyed in this system?" & "What pattern do you see regarding the movement of Nitrogen in the system?"

Day 8

Introduce project and show students good examples and bad examples of the project. Show the students an example using the conquest of Mexico and the introduction of non-native species. Predict results based on Bean hunter lab and food web / Water cycle / Nitrogen cycle information, reviewing concepts previously covered.

Day 9

Students begin library research on their chosen topic taken from list

Day 10

Students continue researching in the library and begin typing their report. Also, students will collect list of animals and plants that do or might live in the same area as their ecological issue.

Day 11

Students will finish typing their reports and complete their list of organisms that live in the area

Day 12

Create Food web with collected organisms, labeling each appropriately.
Create Water cycle diagram and Nitrogen cycle diagram from information collected.
Begin identifying and labeling diagrams with ecological issue's impact on the system.

Day 13

Finish identifying and labeling impact points. Then find a partner who has a different ecological issue and begin comparing and contrasting the impacts that the issues have on the environment. Make a value judgment about whose ecological issue is the most detrimental to the environment

Students should have a lists of similarities and differences between their two issues, and written statement about which is worse for the environment with supporting evidence and explanation.

Day 14

Students will begin presenting with their partners the comparison made between their ecological issues covering the following points:

- What are the issues? Explain in a few sentences what is going on in each issue.
- Point out major differences and similarities between both issues.
- Identify the more devastating issue and explain what led you to choose that one over the other.

Day 15

Continue with presentations

Research Report : Ecological Issue

Teacher Name: **Mr. Simonds**

Student Name: _____

CATEGORY	4	3	2	1
Mechanics	No grammatical, spelling or punctuation errors.	Almost no grammatical, spelling or punctuation errors	A few grammatical spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.
Amount of Information	All topics are addressed and all questions answered with at least 2 sentences about each.	All topics are addressed and most questions answered with at least 2 sentences about each.	All topics are addressed, and most questions answered with 1 sentence about each.	One or more topics were not addressed.
Quality of Information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.

Scientific Drawings : Report Food Web

Teacher Name: **Mr. Simonds**

Student Name: _____

CATEGORY	4	3	2	1
Title	Title is informative, centered, and larger than other text.	Title is informative and larger than other text.	Title is informative and centered.	The title is incomplete and does not clearly indicate what organism is pictured.
Labels	Every item that needs to be identified has a label. It is clear which label goes with which structure.	Almost all items (90%) that need to be identified have labels. It is clear which label goes with which structure.	Most items (75-89%) that need to be identified have labels. It is clear which label goes with which structure.	Less than 75% of the items that need to be identified have labels OR it is not clear which label goes with with item.
Accuracy	95% or more of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. 94-85% of the assigned structures are labeled accurately.	Less than 85% of the assigned structures are drawn AND/OR labeled accurately.
Drawing - general	Lines are clear and not smudged. There are almost no erasures or stray marks on the paper. Color is used carefully to enhance the drawing. Stippling is used instead of shading. Overall, the quality of the drawing is excellent.	There are a few erasures, smudged lines or stray marks on the paper, but they do not greatly detract from the drawing. Color is used carefully to enhance the drawing. Overall, the drawing is good.	There are a few erasures, smudged lines or stray marks on the paper, which detract from the drawing OR color is not used carefully. Overall, the quality of the drawing is fair.	There are several erasures, smudged lines or stray marks on the paper, which detract from the drawing. Overall, the quality of the drawing is poor.
Drawing - details	All assigned details have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. A few details are difficult to identify.	Fewer than 85% of the assigned details are present OR most details are difficult to identify.

Scientific Drawings : Nitrogen Cycle

Teacher Name: **Mr. Simonds**

Student Name: _____

CATEGORY	4	3	2	1
Title	Title is informative, centered, and larger than other text.	Title is informative and larger than other text.	Title is informative and centered.	The title is incomplete and does not clearly indicate what organism is pictured.
Labels	Every item that needs to be identified has a label. It is clear which label goes with which structure.	Almost all items (90%) that need to be identified have labels. It is clear which label goes with which structure.	Most items (75-89%) that need to be identified have labels. It is clear which label goes with which structure.	Less than 75% of the items that need to be identified have labels OR it is not clear which label goes with with item.
Accuracy	95% or more of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. 94-85% of the assigned structures are labeled accurately.	Less than 85% of the assigned structures are drawn AND/OR labeled accurately.
Drawing - general	Lines are clear and not smudged. There are almost no erasures or stray marks on the paper. Color is used carefully to enhance the drawing. Stippling is used instead of shading. Overall, the quality of the drawing is excellent.	There are a few erasures, smudged lines or stray marks on the paper, but they do not greatly detract from the drawing. Color is used carefully to enhance the drawing. Overall, the drawing is good.	There are a few erasures, smudged lines or stray marks on the paper, which detract from the drawing OR color is not used carefully. Overall, the quality of the drawing is fair.	There are several erasures, smudged lines or stray marks on the paper, which detract from the drawing. Overall, the quality of the drawing is poor.
Drawing - details	All assigned details have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. A few details are difficult to identify.	Fewer than 85% of the assigned details are present OR most details are difficult to identify.

Scientific Drawings : Water cycle

Teacher Name: **Mr. Simonds**

Student Name: _____

CATEGORY	4	3	2	1
Title	Title is informative, centered, and larger than other text.	Title is informative and larger than other text.	Title is informative and centered.	The title is incomplete and does not clearly indicate what organism is pictured.
Labels	Every item that needs to be identified has a label. It is clear which label goes with which structure.	Almost all items (90%) that need to be identified have labels. It is clear which label goes with which structure.	Most items (75-89%) that need to be identified have labels. It is clear which label goes with which structure.	Less than 75% of the items that need to be identified have labels OR it is not clear which label goes with with item.
Accuracy	95% or more of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. All assigned structures are labeled accurately.	94-85% of the assigned structures are drawn accurately and are recognizable. 94-85% of the assigned structures are labeled accurately.	Less than 85% of the assigned structures are drawn AND/OR labeled accurately.
Drawing - general	Lines are clear and not smudged. There are almost no erasures or stray marks on the paper. Color is used carefully to enhance the drawing. Stippling is used instead of shading. Overall, the quality of the drawing is excellent.	There are a few erasures, smudged lines or stray marks on the paper, but they do not greatly detract from the drawing. Color is used carefully to enhance the drawing. Overall, the drawing is good.	There are a few erasures, smudged lines or stray marks on the paper, which detract from the drawing OR color is not used carefully. Overall, the quality of the drawing is fair.	There are several erasures, smudged lines or stray marks on the paper, which detract from the drawing. Overall, the quality of the drawing is poor.
Drawing - details	All assigned details have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. The details are clear and easy to identify.	Almost all assigned details (at least 85%) have been added. A few details are difficult to identify.	Fewer than 85% of the assigned details are present OR most details are difficult to identify.

Oral Presentation Rubric : Ecological Issue Comparisson

Teacher Name: **Mr. Simonds**

Student Name: _____

CATEGORY	4	3	2	1
Content	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Comprehension	Student is able to accurately answer almost all questions posed by classmates about the topic.	Student is able to accurately answer most questions posed by classmates about the topic.	Student is able to accurately answer a few questions posed by classmates about the topic.	Student is unable to accurately answer questions posed by classmates about the topic.
Speaks Clearly	Speaks clearly and distinctly all (100-95%) the time, and mispronounces no words.	Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word.	Speaks clearly and distinctly most (94-85%) of the time. Mispronounces no more than one word.	Often mumbles or can not be understood OR mispronounces more than one word.
Listens to Other Presentations	Listens intently. Does not make distracting noises or movements.	Listens intently but has one distracting noise or movement.	Sometimes does not appear to be listening but is not distracting.	Sometimes does not appear to be listening and has distracting noises or movements.